4.2.3.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at INEL are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.3.9–1 and 4.2.3.9–2 for the public and workers, respectively. Impacts from hazardous chemicals are presented in Table 4.2.3.9–3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.3.9–4 through 4.2.3.9–7. Detailed results are presented in Appendix M.

Preferred Alternative: No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the sitewide INEL missions, including interim storage of Pu. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at INEL, where Pu is in interim storage, is described in Section 3.4. The site has identified those facilities that will continue to operate under the No Action Alternative, including interim Pu storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects on the public and workers at INEL are described below.

Under No Action Alternative, weapons-usable Pu material at ANL-W would continue to be stored in the material forms deemed most stable according to the ANL-W Plutonium ES&H Vulnerability Assessment Plan (October 31, 1994).

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.3.9–1 under this alternative at INEL. The annual dose of 0.018 mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7}. This activity would be included in a program to ensure that doses to the public are ALARA. The annual dose of 2.4 person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative, shown in Table 4.2.3.9–2, the annual average dose to a noninvolved (No Action) site worker and the annual dose to the noninvolved (No Action) total site workforce would be 30 mrem and 220 person-rem, respectively, for total site operations. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 6.0×10^{-4} and the projected number of fatal cancers among all workers from 50 years of total size operations would be 4.4.

The average annual average dose to a worker involved in the No Action storage operations would be 26 mrem/yr with a total involved No Action workforce dose of 1.5 person-rem. The associated risk of latent fatal cancer to the average No Action involved worker from 50 years of operation would be 5.1×10^{-4} and the projected number of latent fatal cancers among the No Action involved workforce from 50 years of operation would be 0.029.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public resulting from the normal operation under No Action at INEL are presented in Table 4.2.3.9–3. The hazardous chemical impacts from current site

operations represent the baseline total site impacts for the various storage alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operation at INEL would make up nearly all of the exposures to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations) are considered negligible for purposes of risk calculations.

The HI to the MEI of the public at INEL resulting from normal operation under the No Action Alternative is 1.5×10^{-2}, and the cancer risk is 3.6×10^{-6}. The HI to the onsite worker is 0.22, and the cancer risk is 7.7×10^{-4}.

Facility Accidents. Under the No Action alternative, Pu would continue to be stored at INEL in existing facilities. These facilities currently operate in accordance with DOE Orders, which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

The *Final Safety Analysis Report for the Fuel Manufacturing Facility, Building 704* (ANL-IFR-57) and the *Final Safety Analysis Report of the Zero Power Plutonium Reactor Facility* (ANL-7471) at ANL-W analyzed a wide spectrum of design-basis accidents. These studies indicate that these facilities are low hazard based on the effects of design-basis accidents. However, these studies do not normally analyze the effects of severe accidents. An estimate of the effects of potential severe accidents in the existing storage vault at INEL can be derived from similar storage accidents that have been postulated for an upgraded storage facility. A severe consequence, low frequency accident for storage under the No Action Alternative would be a beyond design basis earthquake. If this accident were to occur, there would be an estimated 0.33 cancer fatalities in the offsite population within 80 km (50 mi). The estimated frequency of the earthquake with sufficient damage to cause a release is approximately 1.0×10^{-7} per year, which corresponds to a risk of 3.3×10^{-8} cancer fatalities per year. For the MEI and noninvolved worker, the corresponding impacts are 9.8×10^{-4} and 0.02 latent cancer fatalities, respectively, if the accident occurred. The risks would be 9.8×10^{-11} and 2.0×10^{-9} cancer fatalities per year. A potentially more frequent accident is penetration of the PCV caused by corrosion. If this accident were to occur, the estimated number of cancer fatalities in the offsite population would be 5.1×10^{-4}. The estimated frequency of this accident is 0.064 per year, which corresponds to a risk to the offsite population of 3.3×10^{-5} cancer fatalities per year. For the MEI and noninvolved worker the corresponding impacts are 1.6×10^{-6} and 2.3×10^{-5} latent cancer fatalities, respectively, if the accident occurred. The risks would be 1.0×10^{-7} and 1.5×10^{-6} cancer fatalities per year.

Upgrade Alternative

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the upgraded Pu storage alternative at INEL. The section describes the impacts from normal facility operations at INEL; this is followed by a description of impacts from facility accidents.

[Text deleted.]

Normal Operation. There would be no radiological releases during the modification or construction of storage facilities at INEL. Construction worker exposures to materials potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects on the public and workers at INEL are described below.

Radiological Impacts. Doses to the public from storage under the Upgrade Alternative are included in Table 4.2.3.9–1. Because facility and design features would improve under the Upgrade Alternative, these doses and resulting fatal cancers are surmised to be even smaller than those associated with storage under the No Action alternative. The dose to the MEI of the public due to annual operations under the Upgrade Alternative would be 5.1×10^{-7} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.3×10^{-11}. The impacts to the average individual would be less. As a result of operation under this alternative in the year 2030, the population dose would be 3.2×10^{-6} person-rem. The corresponding number of fatal cancers in this population due to 50 years of operation would be 7.2×10^{-8}.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operations, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7}. These values are presented in Table 4.2.3.9–1. The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operations in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9–2. Included are involved workers directly associated with upgraded storage, workers who are not involved with the storage facilities, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operations are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the upgraded storage facilities at INEL are presented in Table 4.2.3.9–3. The impacts from total site operations, including the upgraded storage facilities, are also included in this table. Total site impacts, which include the No Action impact plus the storage impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.2×10^{-5}, and the cancer risk is 5.9×10^{-8} as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation because exposures would be expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 3.7×10^{-4}, and the cancer risk is 1.2×10^{-5} as a result of operation of the upgraded storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation because exposures are expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 0.22 and a cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. Modification of the existing Pu storage facilities at INEL may change the existing risks of accidents to workers and the public. ANL-W facilities would be modified and would be in compliance with DOE orders and other applicable regulations and standards. This may result in a reduction of risk compared to No Action.

A set of potential accidents have been postulated for upgraded existing storage facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The impacts of potential accidents and the release of Pu would be dominated by the impacts associated with exposure to Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.33 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (that is, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5}, once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.6×10^{-6}, 4.9×10^{-9}, and 1.0×10^{-7}, respectively. The maximum population 50-year facility lifetime risk would be 1.6×10^{-3} (for example, one fatality in about 31,500 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.0×10^{-6} and 7.5×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–4.

During normal operation at INEL, operation under the upgraded Pu storage alternative would result in impacts that are within applicable regulatory limits. Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing and Construct New Argonne National Laboratory–West Facilities for Continued Plutonium Storage

Normal Operation. During normal operations, there would be only a negligible difference in radiological and hazardous chemical impacts if Pu from RFETS and LANL is included in the Upgrade Storage Alternative. Therefore, the impacts are essentially the same as presented in the previous subsection discussing the Upgrade Without RFETS or LANL Pu.

Facility Accidents. A set of potential accidents have been postulated for the incremental impacts for upgraded storage of LANL and RFETS Pu for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–5. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.037 at INEL for the beyond design basis earthquake accident scenario with an estimate probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5}, once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk

Table 4.2.3.9–4. Upgrade Without Rocky Flats Environmental Technology Site or Los Alamos National Laboratory Material Alternative—Accident Impacts at Idaho National Engineering Laboratory

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatalities (per 50 yr)[a]	Number of Cancer Fatalities[c]	Accident Frequency (per yr)
PCV puncture by forklift	1.7×10^{-7}	5.6×10^{-6}	1.1×10^{-8}	3.8×10^{-7}	3.7×10^{-6}	1.2×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	9.9×10^{-9}	5.6×10^{-7}	6.6×10^{-10}	3.8×10^{-8}	2.2×10^{-7}	1.2×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	7.5×10^{-5}	2.3×10^{-5}	5.0×10^{-6}	1.6×10^{-6}	1.6×10^{-3}	5.1×10^{-4}	0.064
Vault fire	6.5×10^{-8}	0.013	3.3×10^{-9}	6.6×10^{-4}	1.1×10^{-6}	0.22	1.0×10^{-7}
Truck bay fire	4.0×10^{-9}	8.0×10^{-4}	2.7×10^{-10}	5.4×10^{-5}	8.9×10^{-8}	0.018	1.0×10^{-7}
Spontaneous combustion	7.9×10^{-12}	1.1×10^{-6}	5.3×10^{-13}	7.5×10^{-8}	1.7×10^{-10}	2.5×10^{-5}	7.0×10^{-7}
Explosion in the vault	4.6×10^{-8}	9.1×10^{-3}	2.5×10^{-9}	4.9×10^{-4}	8.2×10^{-7}	0.16	1.0×10^{-7}
Explosion outside of vault	4.0×10^{-11}	8.0×10^{-6}	2.7×10^{-12}	5.4×10^{-7}	8.9×10^{-10}	1.8×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.5×10^{-12}	3.0×10^{-7}	4.8×10^{-11}	9.6×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.0×10^{-7}	0.020	4.9×10^{-9}	9.8×10^{-4}	1.6×10^{-6}	0.33	1.0×10^{-7}
Expected risk[d]	7.5×10^{-5}	–	5.0×10^{-6}	–	1.6×10^{-3}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-7}, 8.6×10^{-11}, and 1.1×10^{-8}, respectively. The maximum population 50-year facility lifetime risk would be 1.3×10^{-4} (for example, one fatality in about 38,500 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 6.6×10^{-3} per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.9×10^{-8} and 5.6×10^{-6} respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenario identified in Table 4.2.3.9–5. Table 4.2.3.9–5 also shows the combined expected risk for storage of existing Pu and the RFETS and LANL materials.

During normal operation at INEL, operation under the upgraded Pu storage alternative would result in impacts that are within applicable regulatory limits. Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Table 4.2.3.9–5. Upgrade With Rocky Flats Environmental Technology Site and Los Alamos National Laboratory Material Alternative—Accident Impacts at Idaho National Engineering Laboratory

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Number of Cancer Fatalities[c]	Accident Frequency (per yr)
PCV puncture by forklift	1.2×10^{-7}	4.1×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	2.9×10^{-6}	9.6×10^{-5}	6.0×10^{-4}
PCV breach by firearms discharge	7.2×10^{-9}	4.1×10^{-7}	7.8×10^{-11}	4.4×10^{-9}	1.7×10^{-7}	9.6×10^{-6}	3.5×10^{-4}
PCV penetration by corrosion	5.6×10^{-6}	1.7×10^{-5}	5.9×10^{-8}	1.8×10^{-7}	1.3×10^{-4}	3.9×10^{-4}	6.6×10^{-3}
Vault fire	5.8×10^{-9}	1.1×10^{-3}	4.8×10^{-11}	9.5×10^{-5}	1.0×10^{-7}	0.021	1.0×10^{-7}
Truck bay fire	2.9×10^{-9}	5.7×10^{-4}	3.1×10^{-11}	6.2×10^{-6}	6.7×10^{-8}	0.013	1.0×10^{-7}
Spontaneous combustion	2.9×10^{-11}	8.2×10^{-7}	3.1×10^{-13}	8.9×10^{-9}	6.7×10^{-10}	1.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	6.9×10^{-10}	1.3×10^{-4}	7.5×10^{-12}	1.5×10^{-6}	1.6×10^{-8}	3.2×10^{-3}	1.0×10^{-7}
Explosion outside of vault	3.1×10^{-11}	6.2×10^{-6}	3.3×10^{-13}	6.7×10^{-8}	7.2×10^{-10}	1.4×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.9×10^{-13}	3.9×10^{-8}	4.5×10^{-11}	8.9×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-8}	2.2×10^{-3}	8.6×10^{-11}	1.7×10^{-5}	1.8×10^{-7}	0.037	1.0×10^{-7}
Expected risk[d]	5.6×10^{-6}	–	5.9×10^{-8}	–	1.3×10^{-4}	–	–
Combined expected risk[e]	8.1×10^{-5}	–	5.1×10^{-6}	–	1.7×10^{-3}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the incremental risks for the additional RFETS and LANL material over the lifetime of the plant.

[e] Combined expected risk for upgrade of existing storage and RFETS and LANL storage.

Note: All values are mean values.

Source: Calculated using Table 4.2.3.9–6.

Consolidation Alternative

Construct New Plutonium Storage Facility

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the new consolidated Pu storage facility at INEL. Normal operation of the consolidated storage facility would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at INEL. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However,

concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects on the public and workers at INEL are described below.

Radiological Impacts. Radiological impacts on the public resulting from the normal operation of the new consolidated storage facility are presented in Table 4.2.3.9–1. The impacts from all site operations, including the new consolidated Pu storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 1.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.0×10^{-11}. The impacts on the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 1.8×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 4.5×10^{-7}.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.4×10^{-7}. The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9–2. Included are involved workers directly associated with the new consolidated storage facility, workers who are not involved with the new storage facility, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at INEL are presented in Table 4.2.3.9–3. The impacts from all site operations, including the consolidated storage facility, are included in this table. Total site impacts, which include the No Action impact plus the consolidation alternative, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 4.5×10^{-5}, and the cancer risk is 5.9×10^{-8} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected remain the same. The total site operation, including the consolidated facility, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.3×10^{-3}, and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the consolidated Pu storage facility, would result in an HI of 0.22 and a cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for consolidation of Pu for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident

consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–6. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.36 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5}, once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-6}, 8.4×10^{-10}, and 1.1×10^{-7}, respectively. The maximum population 50-year facility lifetime risk would be 1.2×10^{-3} (for example, one fatality in about 42,000 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-7} and 5.4×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities

Table 4.2.3.9–6. Consolidation Alternative Accident Impacts at Idaho National Engineering Laboratory

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	**Risk of Cancer Fatality (per 50 yr)[a]**	**Probability of Cancer Fatality[b]**	**Risk of Cancer Fatality (per 50 yr)[a]**	**Probability of Cancer Fatality[b]**	**Risk of Cancer Fatality (per 50 yr)[a]**	**Number of Cancer Fatalities[c]**	**Accident Frequency (per yr)**
PCV puncture by forklift	1.2×10^{-7}	4.1×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	2.9×10^{-6}	9.6×10^{-5}	6.0×10^{-4}
PCV breach by firearms discharge	7.2×10^{-9}	4.1×10^{-7}	7.8×10^{-11}	4.4×10^{-9}	1.7×10^{-7}	9.6×10^{-6}	3.5×10^{-4}
PCV penetration by corrosion	5.4×10^{-5}	1.7×10^{-5}	5.8×10^{-7}	1.8×10^{-7}	1.2×10^{-3}	3.9×10^{-4}	0.064
Vault fire	5.7×10^{-8}	0.011	4.7×10^{-10}	9.3×10^{-4}	1.0×10^{-6}	0.20	1.0×10^{-7}
Truck bay fire	2.9×10^{-9}	5.7×10^{-4}	3.1×10^{-11}	6.2×10^{-6}	6.7×10^{-8}	0.013	1.0×10^{-7}
Spontaneous combustion	2.9×10^{-11}	8.2×10^{-7}	3.1×10^{-13}	8.9×10^{-9}	6.7×10^{-10}	1.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	6.7×10^{-9}	1.3×10^{-3}	7.3×10^{-11}	1.5×10^{-5}	1.6×10^{-7}	0.031	1.0×10^{-7}
Explosion outside of vault	3.1×10^{-11}	6.2×10^{-6}	3.3×10^{-13}	6.7×10^{-8}	7.2×10^{-10}	1.4×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.9×10^{-13}	3.9×10^{-8}	4.5×10^{-11}	8.9×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-7}	0.021	8.4×10^{-10}	1.7×10^{-4}	1.8×10^{-6}	0.36	1.0×10^{-7}
Expected risk[d]	5.4×10^{-5}	–	5.8×10^{-7}	–	1.3×10^{-3}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at INEL. This storage would take place in a new Pu and HEU storage facility. Normal operation of the new collocated storage facility at INEL would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at INEL. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects on the public and workers are described below.

Radiological Impacts. Radiological impacts on the public resulting from the normal operation of the new collocated storage facility at INEL are presented in Table 4.2.3.9–1. The impacts from all site operations, including the new storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 1.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 4.0×10^{-11}. The impacts on the average individual would be less. As a result of storage facility operation in the year 2030, the population dose would be 1.8×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 4.5×10^{-7}.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 0.018 mrem. From 50 years of operation, the corresponding risks of fatal cancer to this individual would be 4.4×10^{-7}. The impacts on the average individual would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 2.4 person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 0.061.

Doses to onsite workers from normal operations are given in Table 4.2.3.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the new storage facility, and the entire workforce at INEL. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts on the public and on the onsite worker resulting from the normal operations of the new consolidated Pu storage facility and collocation with HEU storage facilities at INEL are presented in Table 4.2.3.9–3. The impacts from all site operations, including the consolidation of Pu and collocation with HEU storage facilities are also included in this table. Total site impacts, which include the No Action impact plus the facility, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 7.7×10^{-5}, and the cancer risk is 5.9×10^{-8} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the new facility, would result in an HI of 1.5×10^{-2} and a cancer risk of 3.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 1.9×10^{-3}, and the cancer risk is 1.2×10^{-5} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the new facility would result in an HI of 0.22 and an cancer risk of 7.8×10^{-4} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for collocation of Pu and HEU for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.3.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.36 at INEL for the beyond design basis earthquake accident scenario with an estimated probability of 1.0×10^{-7} per year (for example, probability of severe earthquake occurring is estimated to be about 1.0×10^{-5}, once in 100,000 years, multiplied by a damage and release probability of 0.01). The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.8×10^{-6}, 8.4×10^{-10}, and 1.1×10^{-7}, respectively. The maximum population 50-year facility lifetime risk would be 1.2×10^{-3} (for example, one fatality in about 42,000 years) at INEL for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-7} and 5.4×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.3.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Prior to construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Material

If the strategic reserve and weapons R&D is not included, the impacts on the public and on workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the Upgrade With

Table 4.2.3.9–7. Collocation Alternative Accident Impacts at Idaho National Engineering Laboratory

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Number of Cancer Fatalities[c]	Accident Frequency (per yr)
PCV puncture by forklift	1.2×10^{-7}	4.1×10^{-6}	1.3×10^{-9}	4.4×10^{-8}	2.9×10^{-6}	9.6×10^{-5}	6.0×10^{-4}
PCV breach by firearms discharge	7.2×10^{-8}	4.1×10^{-7}	7.8×10^{-11}	4.4×10^{-9}	1.7×10^{-7}	9.6×10^{-6}	3.5×10^{-4}
PCV penetration by corrosion	5.4×10^{-5}	1.7×10^{-5}	5.8×10^{-7}	1.8×10^{-7}	1.2×10^{-3}	3.9×10^{-4}	0.064
Vault fire	5.7×10^{-8}	0.011	4.7×10^{-10}	9.3×10^{-4}	1.6×10^{-6}	0.26	1.0×10^{-7}
Truck bay fire	2.9×10^{-9}	5.7×10^{-4}	3.1×10^{-11}	6.2×10^{-6}	6.7×10^{-8}	0.013	1.0×10^{-7}
Spontaneous combustion	2.9×10^{-11}	8.2×10^{-7}	3.1×10^{-13}	8.9×10^{-8}	6.7×10^{-10}	1.9×10^{-5}	7.0×10^{-7}
Explosion in the vault	6.7×10^{-9}	1.3×10^{-3}	7.3×10^{-10}	1.5×10^{-5}	1.6×10^{-7}	0.031	1.0×10^{-7}
Explosion outside of vault	3.1×10^{-11}	6.2×10^{-6}	3.3×10^{-13}	6.7×10^{-8}	7.2×10^{-10}	1.4×10^{-4}	1.0×10^{-7}
Nuclear criticality	2.0×10^{-11}	4.0×10^{-6}	1.9×10^{-13}	3.9×10^{-8}	4.5×10^{-11}	8.9×10^{-6}	1.0×10^{-7}
Beyond evaluation basis earthquake	1.1×10^{-7}	0.021	8.4×10^{-10}	1.7×10^{-4}	1.8×10^{-6}	0.36	1.0×10^{-7}
Expected risk[d]	7.5×10^{-5}	–	5.8×10^{-7}	–	1.3×10^{-3}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual) or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

All or Some RFETS and LANL Pu Subalternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at INEL would reduce the impacts from radiological and chemical releases and exposures to levels slightly below the No Action levels. All workers involved in the removal of the Pu from INEL would be monitored to assure that their doses remain within regulatory limits and as low as reasonably achievable.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.